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QUALITY ASSURANCE PROJECT PLAN FOR USE AND ATTAINABILITY ANALYSIS OF COFFEE CREEK AND MOSSY LAKE

Prepared for:
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Crossett, Arkansas

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AquAeTer, Inc.
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John Michael Corn

AquAeTer Project Manager

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Michal R. Corn

AquAeTer Technical Project Manager

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Jim Cutberth

Georgia-Pacific Crossett

Signature: ______________________________

Print Name: ______________________________

Representative, Arkansas Department of Environmental Quality

SECTION 1

PROJECT MANAGEMENT

1.1 DISTRIBUTION LIST

The following organizations will receive copies of the approved quality assurance project plan (QAPP) and all approved changes to the QAPP.

1. Arkansas Department of Environmental Quality;
2. Georgia-Pacific LLC; and
3. **AquAeTer, Inc.**

1.2 PROJECT/TASK ORGANIZATION

All project activities covered by the QAPP are performed for Georgia-Pacific by Georgia Pacific, **AquAeTer** and its subcontractors. The primary individuals and organizations participating in the project and their roles and responsibilities are identified below.

1.2.1 Arkansas Department of Environmental Quality

The Arkansas Department of Environmental Quality (ADEQ) is the regulator for this UAA.

1.2.2 Georgia-Pacific LLC

Georgia-Pacific Crossett (Georgia-Pacific) is the principal data user for this report.

1.2.3 AquAeTer, Inc.

AquAeTer will be the information producers for this UAA. Principal roles are outlined below.

Note: **AquAeTer** will secure written documentation from its subcontractors stating the organization's awareness of and commitment to requirements contained in this quality assurance project plan and any amendments or revisions of this plan. **AquAeTer** will maintain this documentation as part of the project's quality assurance records, and will ensure that the document is available for review.

1.2.3.1 Technical Director

The Technical Director is responsible for submit accurate and timely deliverables to Georgia-Pacific for submission to the Arkansas Department of Environmental Quality (ADEQ); being the technical advisor for all field and laboratory activities; and final approval for all deviations from the QAPP and Work Plan. The Project Manager will be Michael R. Corn.

1.2.3.2 Project Manager

The Project Manager is responsible for implementing the requirements in the Work Plan and in the QAPP. The Project Manger will assess the quality of subcontractor/participant work as defined in the Work Plan; coordinate activities of the field crew to ensure project objectives are met; identify, receive, and maintain project quality assurance records; submit accurate and timely deliverables to Georgia-Pacific for submission to the Arkansas Department of Environmental Quality (ADEQ); supervising all aspects of the sampling and measurement of surface waters and other parameters in the field; supervision the acquisition of water samples and field data measurements in a timely manner that meet the quality objectives specified in the Work Plan; field scheduling, staffing, and ensuring the staff are appropriately trained; preparing status reports and communicating problems and progress to the client; overseeing data management for the study and coordinate attendance at conference calls, training events, meetings, and related project activities. The Project Manager will be John Michael Corn.

1.2.3.3 Quality Assurance Officer

The Quality Assurance Officer will be responsible for the following: reviewing and approving the QAPP and ensuring the quality of data submitted to Georgia-Pacific for submission to ADEQ; verifying data prior to the submission of data to Georgia-Pacific for submission to ADEQ; coordinating with Project Manager and Technical Director to resolve QA related issues; maintaining written records for subcontractor commitment to requirements specified in this QAPP; maintaining records of hard copy QAPP distribution, including appendices and amendments. The Quality Assurance Officer will be Pamela Hoover.

1.2.3.4 Health and Safety Manager

The Health and Safety Manager will be responsible for: producing the Health and Safety Plan (HASP); conduct training to inform field team members on potential hazards of field activities; determining the closest emergency medical facility to the field activities; and conducting any follow up review of any incidences or near-misses. The Health and Safety Manager will be Pamela Hoover.

1.3 PROBLEM DEFINITION

The purpose of this project is to determine if the current designated use for Coffee Creek and Mossy Lake is appropriate and if any revisions to the designated use for these water bodies should be made. Both water bodies are located within the Ouachita River Basin. The study area consists of Coffee Creek upstream from its confluence with the Georgia-Pacific treated effluent, Indian Creek, and Mossy Lake. It should be noted that the purpose of this study does not include the analysis of water quality conditions in the Ouachita River.

The USEPA Region 6 published, through its contractor, Parsons, the *Use Attainability Analysis and Water Quality Assessment of Coffee Creek, Mossy Lake, and the Ouachita River* in December 2007. **AquAeTer, Inc.** (**AquAeTer**) reviewed this document and found that there was limited available data in regards to water quality, habitat assessment, and biological analyses. In response to the review, an additional study is needed to address the data gaps and to assess the appropriate designated use of Coffee Creek and Mossy Lake.

Given the need for additional data, Georgia-Pacific has contracted **AquAeTer** to develop a Use Attainability Analysis of Coffee Creek and Mossy Lake. This study will include conducting field assessments of relevant habitats, collecting and analyzing macroinvertebrate and fish species, and obtaining water quality data. The data will be collected at six sites on Coffee Creek and Mossy Lake, a site on Wildcat Lake (or an alternate lake), and a site at an unnamed reference stream in Felsenthal Wildlife Management Area. An unnamed Felsenthal Wildlife Management Area Reference Stream, and Wildcat Lake. If Wildcat Lake cannot be accessed, either Pete Wilson Lake or Grand Marais Lake in the Felsenthal Wildlife Management Area will be used. The unnamed Felsenthal Wildlife Management Area Reference Stream is similar to the upstream physical and ecological attributes of Coffee Creek and will be used as a Reference stream to compare the water quality conditions of Coffee Creek and Indian Creek. Wildcat Lake (or an alternate lake) will be used as a reference lake to Mossy Lake. All of the tasks of this study will be performed under the Work plan. The area of investigation is located in southern Arkansas, as shown in Figure 1. The proposed sampling stations are presented in Figure 2.

1.3.1 Description of Waterbodies

1.3.1.1 Ouachita River

This study is to determine if the current designated use for Coffee Creek and Mossy Lake is appropriate and if any revisions to the designated use for these water bodies should be made. This study is not designed to include the Ouachita River. However, it is important to describe the Ouachita River when discussing Coffee Creek and Mossy Lake because annual flooding of the Ouachita River inundates portions of Coffee Creek and Mossy Lake. At these times, these streams are a part of the Ouachita River. This study will not attempt to complete sampling of these sites when the Ouachita River has inundated any of the selected stations.

The headwaters of the Ouachita River are in the Ouachita Mountains near Eagleton, in western Arkansas. The water flows southeast to form Lake Ouachita near Hot Springs, Arkansas. The River then continues south through a series of lakes, including Felsenthal Reservoir, which is approximately 6-miles upstream from the Arkansas-Louisiana border. The Ouachita River then flows through northeast Louisiana and joins the Tensas River to form the Black River. The Black River is a large tributary to the Red River, which is a tributary of the Mississippi River.

A chain of locks and dams on the river was initiated by the Vicksburg District, U.S. Army Corps of Engineers in the 1960s with the objective being to link the ports along the Ouachita River to the Gulf of Mexico. This was achieved in 1984 with completion of the H. K. Thatcher and Felsenthal locks and dams in southern Arkansas. These locks, along with Columbia and Jonesville locks in Louisiana now provide year-round 9-foot navigation to Camden, Arkansas. The 6 miles of the Ouachita River between Felsenthal Dam and the state line has a slight gradient (<0.5 feet/mile), steep cut sandy banks, deep channel, no riffle areas, a heavy sediment load, and a bottom characterized as shifting sand and silt (LORWG 1993).

1.3.1.2 Coffee Creek

Coffee Creek begins in the City of Crossett and effectively begins at Lucas Pond, as shown on the USGS topographic map presented as Figure 3. Coffee Creek at this point is an upland creek and is not inundated by the yearly floods on the Ouachita River. Coffee Creek then proceeds in a southeasterly direction around the City of Crossett Facultative Pond, then onto the Georgia-Pacific property near the aeration stabilization basin (ASB), and then heads in a southerly direction to the east of the ASB effluent canal until a point about 0.8 mile upstream from Mossy Lake where it commingles with the Georgia-Pacific effluent canal and enters Mossy Lake. Coffee Creek travels through Mossy Lake and continues from the outfall of Mossy Lake through a man made channel for approximately 0.59 mile to the Ouachita River at about Ouachita River Mile (ORM) 221.9. Historically, the Georgia-Pacific effluent traveled down Coffee Creek from the Mill to treatment in Mossy Lake. Additional wastewater treatment technologies were added and an effluent canal was constructed to separate the treated effluent from Coffee Creek.

However, during the historical highest recorded flood event, the Ouachita River extended to the Georgia-Pacific ASB dikes. Annual normal flooding can inundate large portions of Coffee Creek.

1.3.1.3 Mossy Lake

Mossy Lake appears to have been an old oxbow of the Ouachita River. The lake is about 584 acres in size. The water depths in Mossy Lake range from about 10 ft at the present day Georgia-Pacific Stream Monitoring Station (SMS) 002 structure to 1 to 2 ft of depth for the most of the Lake. Georgia-Pacific currently maintains the water depth in Mossy Lake with a dike and the SMS 002 structure.

Georgia-Pacific first utilized Mossy Lake for effluent treatment in the late 1930s prior to any regulatory standards on the Ouachita River or technology standards requiring wastewater treatment. A weir was located in Coffee Creek about 0.25-mile downstream from where the current SMS 002 structure is located, and it still exists today. Currently, the effluent 5-day biochemical oxygen demand (BOD_5) discharged from the ASB at Outfall 001 undergoes further degradation in Mossy Lake and the effluent BOD_5 concentrations and loadings are reduced about 50% in Mossy Lake, allowing Georgia-Pacific to meet the more stringent effluent standards required to meet water quality standards specified for the Ouachita River during summer months.

1.3.1.4 <u>Felsenthal Reservoir and Forested Wetlands Areas</u>

The Felsenthal Reservoir was constructed to provide forested wetlands primarily for hunting. Felsenthal Dam located at approximately ORM 227 is designed to operate as free-flow at water surface elevations of greater than 65 ft NGVD. The areas in the Felsenthal forested lands are inundated as well, similar to the Coffee Creek and Mossy Lake area. The streams in the forested wetlands of the Felsenthal Wildlife Management Area are similar in appearance to Coffee Creek and drain similar areas of forested wetlands and swamps.

1.4 PROJECT/TASK DESCRIPTIONS

The purpose of this investigation is to determine if the current “no aquatic life use designation” for Coffee Creek and Mossy Lake is appropriate.

During field activities, field crews will use discretion to ensure personal health and safety. If field crews encounter a situation that risks personal health and safety, including inclement weather, biological hazards, or other risks, they will halt sampling activities and evacuate the area. In addition, some portions of the creek or portions of the lakes may be inaccessible. These areas will be noted and bypassed. Any deviations from the Work Plan will be documented in the field notebook.

During physical, chemical, and biological evaluations, field personnel will attempt to re-visit the same location during each field event. If the station is braided, physical, chemical, and biological evaluations will be made on each braid. Any deviations from the Work Plan will be documented in the field notebook.

1.4.1 UAA Tasks

A UAA will be performed to determine if aquatic life uses for Coffee Creek and Mossy Lake are obtainable. The “Technical Support Manual: Waterbody Surveys and Assessments for

Conducting Use Attainability Analyses" by USEPA (1983) was used as guidance in developing the UAA objectives. Eight stations have been selected for field areas which are described in Section 2.1.4

1.4.1.1 Physical Evaluation

Velocity measurements and habitat descriptions will be conducted for the physical evaluations of the eight sites. Methods are described in the Work Plan and in Section 2.2.1 of this QAPP.

1.4.1.2 Chemical Evaluation

Water quality parameters will be taken for the chemical evaluation of the eight sites. Methods are described in the Work Plan and in Section 2.2.2 of this QAPP.

1.4.1.3 Biological Evaluation

Fish and macroinvertebrates will be sampled and identified for the biological evaluation of the eight sites. Methods are described in the Work Plan and in Section 2.3.4 of this QAPP.

1.4.1.4 Perform Assessment Evaluation

AquAeTer will compare the site assessments of Mossy Lake, Coffee Creek, and Indian Creek with the reference stream and reference lake in Felsenthal Wildlife Management Area.

1.4.2 Personnel and Equipment Requirements

Sampling will be conducted by the **AquAeTer** personnel and any subcontractors. All sampling is to be conducted under the direct supervision of **AquAeTer** personnel.

All equipment requirements for this project will be approved by the Project Manager. Any deviations will be documented in the field notebook.

1.4.3 Revisions to the QAPP

During this project, the QAPP shall be revised as necessary and reissued annually on the anniversary date, or revised and reissued within 120 days of significant changes, whichever is sooner. The last approved version of the QAPP shall remain in effect until revised versions have been approved. If the entire QAPP is current, valid, and accurately reflects the project goals and the organizations policy, the annual reissuance may be pospond by a certification that the plan is current, and include a copy of new, signed approval pages for the QAPP.

1.4.4 Expedited Changes

Expedited changes to the QAPP may be approved to reflect changes in project organization, tasks, schedules, objectives, and methods, address deficiencies and non-conformance, improve operational efficiency; and accommodate unique or unanticipated circumstances. Requests for expedited changes are directed from **AquAeTer** Project Manager to ADEQ in writing. They are effective immediately upon approval by the ADEQ. Expedited changes to the QAPP and the reasons for the changes shall be documented, and revised pages shall be initialed by ADEQ and **AquAeTer**, and then distributed to all persons on the QAPP distribution list.

Expedited changes shall be reviewed, approved, and incorporated into a revised QAPP during the annual revision process or within 120 days of the initial approval in cases of significant changes.

1.5 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

1.5.1 Precision

The precision of data is a measure of the reproducibility of a measurement when a collection or an analysis is repeated. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions.

1.5.2 Accuracy

Accuracy is a statistical measurement of correctness and includes components of systemic error. A measurement is considered accurate when the value reported does not differ from the true value. Accuracy is verified through the analysis of laboratory spikes and blank samples.

1.5.3 Representativeness

The representativeness of the data is dependent on the sampling locations and the sampling procedures to adequately represent the true conditions at the sampling sites. Site selection will assure that the measurement data represents the conditions at the site. Sampling methods and frequency will be optimized to achieve the highest level of representativeness practical.

1.5.4 Comparability

The comparability of the data produced is predetermined by the commitment of the staff to use only approved procedures as described in this QAPP. Comparability is also guaranteed by reporting data in standard units and by using accepted rules for rounding figures.

1.5.5 Completeness

The completeness of the data is basically a relationship of how much of the data is available for use compared to the total potential data. Ideally, 100% of the data should be available. However, the possibility of unavailable data due to accidents, insufficient sample volume, broken or lost samples, etc. is to be expected. Therefore, it will be a general goal of the project(s) that 90% data completion is achieved.

1.6 DOCUMENTATION AND RECORDS

AquAeTer will maintain documentation of all field activities, using field log sheets and field notebooks. The **AquAeTer** SOP F050 Field Book Procedure will be used as guidance for maintaining the field notebook (Appendix A). Any deviations from the Work Plan will be documented in the field notebook.

SECTION 2

DATA GENERATION AND ACQUISITION

2.1 SAMPLING PROCESS DESIGN

2.1.1 Sample Collection

The sampling plan will include four sampling events, as shown on Tables 1 through 5. During the spring and fall sampling events, the field team will sample for macroinvertebrates. During concurrent summers, the field team will sample for fish. During all sample events, the habitat will be evaluated for physical and chemical parameters. **AquAeTer** personnel or subcontractors will conduct sampling activities.

Reasonable effort will be taken to schedule sampling events that fall outside of the annual flooding regime. An indicator of flood conditions used by Georgia-Pacific personnel is when the Ouachita River height at the lower pool at the Felsenthal Lock and Dam is 65 feet MSL or above. No sampling events should be scheduled during these conditions.

2.1.2 Sample Analysis

Samples will be collected by **AquAeTer** personnel or subcontractor and shipped or delivered to the laboratory for analysis.

2.1.3 Sample Design Rationale

The sample design is based on the intent of this study to determine if the current designated use for Coffee Creek and Mossy Lake are appropriate and if any revisions to the designated use for these water bodies should be made.

2.1.4 Site Selection Criteria

Eight sites have been selected to determine if the current designated use for Coffee Creek and Mossy Lake are appropriate and if any revisions to the designated use for these water bodies should be made. Below is a description of the eight sites.

<u>Coffee Creek Background – Site 1.</u> Site 1 on Coffee Creek, located near Lucas Lake, drains an upland area. This site is not ever under the influence of the Georgia-Pacific effluent. The site location is shown on Figure 4. This is a test site chosen because it is upstream of Georgia-Pacific.

Coffee Creek @ Parsons Reference Site – Site 2. Site 2 is located near the Georgia-Pacific effluent canal. Coffee Creek at Site 2 runs to the west of the Georgia-Pacific effluent canal. This site is approximately at elevation 75 ft NGVD and during extreme floods can be inundated by the Ouachita River. During the reconnaissance conducted on March 31, 2011, this location had puddles of water in various stretches of the stream bed. There was little to no flow between the puddles visible at the surface. The site location is presented in Figure 5. This is a test site chosen because it is upstream of Georgia-Pacific and to replicate the Parsons data collection.

Indian Creek near Sulfur Springs – Site 3. Indian Creek is a tributary to Coffee Creek that drains forested wetland and farming areas. It will serve as a reasonably similar drainage basin as the lower part of Coffee Creek. The use of this station will depend on access. The location is presented in Figure 6. This is a test site chosen because it is upstream of Georgia-Pacific.

Coffee Creek near the old Railroad Bridge – Site 4. Coffee Creek at Site 4 runs just west and parallel to the Georgia-Pacific effluent canal. This site is inundated during flooding and waters from Georgia-Pacific could conceivably mix with these waters during flooding events. However, there is a substantial levee (the old railroad raised bed) that lies between the Site 4 and the canal. The site location is shown in Figure 7. This is a test site chosen because it is upstream of Georgia-Pacific.

Coffee Creek near the Confluence with the Georgia-Pacific Effluent Canal – Site 5. Site 5 during flooding may be commingled with the Georgia-Pacific effluent. During dry weather flow, the Site 5 location will be an independent stream. Elevation at this site is approximately 65 ft NGVD based on the USGS topographic map. Sampling at this location will depend on access. The site location is shown on Figure 8. This is a test site chosen because it is upstream of Georgia-Pacific.

Mossy Lake – Site 6. Mossy Lake is approximately 584 acres in size. The majority of Mossy Lake is approximately 1 to 2 feet deep and is influenced considerably by flow from Georgia-Pacific's effluent. This location is shown on Figure 9. This is a test site.

Felsenthal Reference Stream – Site 7. An unnamed, forested wetland tributary located off Pine Island Access Road will be sampled. This tributary is very similar in visual appearance to Coffee Creek. This site location is shown on Figure 10. This is a reference site for Coffee Creek. It was selected because it is in the same Ecoregion as Coffee Creek, is in a Wildlife Management area and should be relatively un-impacted by development or channelization, is similar in basin size, vegetation, habitat characteristics as Coffee Creek, and it is readily accessible by field teams.

Felsenthal Reference Lake– Site 8. Wildcat Lake in the Felsenthal Wildlife Management Area has been selected as the reference Lake for Coffee Creek. At the entrance to Wildcat Lake from the Ouachita River, the water depth was 3 feet. The Reference tributary is located to the northeast of the boat entrance. If Wildcat Lake cannot be accessed, another lake in the Felsenthal Wildlife Management Area will be chosen. The first alternate choice is Pete Wilson Lake. The second alternate choice is Grand Marais. Wildcat Lake, Pete Wilson Lake, and Grand Marais Lake are shown on Figure 11. These lakes were selected as reference lakes because they are in the same Ecoregion as Mossy Lake, and appear to be similar in size, appearance, and hydrology as Mossy Lake.

At these locations, the field site will be chosen to be representative of the area being sampled. Field teams will survey approximately 1,000 feet of the stream and select the location that appears to be most representative of the area. Any deviations from the Work Plan will be documented in the field notebook.

2.2 SAMPLING METHODS REQUIREMENTS

The sampling method requirements are stated in the Work Plan. Any deviations from the Work Plan will be documented in the field notebook. Below is a summary of the methods described in the Work Plan.

2.2.1 Physical Evaluation

The physical evaluation will determine the physical characteristics of Coffee Creek and Mossy Lake. The physical characteristics of a water body influence its reaction to pollution and its natural purification processes. The physical characteristics also play a role in the availability of suitable habitat for aquatic species.

2.2.1.1 Velocity Measurements

Velocity measurements will be taken at each of the eight stations. At the stream stations, the velocity measurements will be taken at the downstream end of the station. In the lakes, the field team will evaluate where taking a transect will be most feasible based on stream characteristics at the time of sampling. Rationale of transect will be documented.

Current measurements will be collected according to the Work Plan and using Standard USGS techniques (Buchanan 1976) and the **AquAeTer** SOP F022 as guidance, which are located in Appendix B. Any deviations will be documented in the field notebook.

2.2.1.2 Habitat Descriptions

For each stream station, the habitat will be described according to the Work Plan and using The Rapid Bioassessment Protocol as guidance. The Rapid Bioassessment Habitat Assessment Field Data Sheet for low gradient streams, located in Appendix C, will be utilized to describe each habitat parameter. Additionally, field crews will create a site sketch of the reach and photograph each station. A log of the photographs will be kept. If the stream reach is braided, each braid will be described. The following characteristics will be described:

1. Suspended Solids and Sedimentation: Reaches will be evaluated for sediment deposition in the channel. The reach will be evaluated based on development of point bars and islands and the evaluation of the movement of sediment. The inorganic substrate components will be estimated for percent composition in the sampling reach;

2. Pools, Riffles, and Substrate Composition: Stream locations will be evaluated on the mix of pools and riffles in addition to evaluating the mixture and type of substrate materials;

3. Channel Characteristics and Effects of Channelization: Stations will be evaluated based on the appearance of channelization, including embankments or shoring structures, bridge abutments, or dredging. The channel flow will be estimated;

4. Temperature: Temperature of the stream channel will be measured using a hand-held meter. Additionally, available cover and vegetative protection will be evaluated to determine shade cover; and

5. Riparian Evaluations: Riparian vegetative zones will be evaluated based on the development of the riparian zone, the bank stability, the amount and type of vegetative protection, and the impact of human activities.

Any deviations will be documented in the field notebook.

2.2.2 Chemical Evaluation

The chemical composition and the chemical interactions of the aquatic environmental exert an important influence on the aquatic life of a water body. Chemical evaluations can also be used to calculate water quality indices, which are used when discussing stream water quality.

Water quality parameters will be taken at each sample location according to methods stated in the Work Plan. If water quality parameters indicate that the lake water column is stratified, a composite sample will be collected from the epiliminion, thermocline, and the hypolimnion. For those areas that are not stratified based on water quality measurements and from all streams, grab samples will be collected from one foot below water surface, except where total water depth is less than two feet. Where the water depth is less than two feet, water samples will be collected at mid-depth in the water column.

In Stream Water Quality Measurements

The following parameters taken instantaneously in the field are:

- Dissolved Oxygen (DO) (% Saturation);
- pH (standard units);
- Specific conductance at 25°C as conductivity;
- Salinity;
- Temperature (ºC) departure from equilibrium; and
- Turbidity (NTU).

The instrument to be used for instantaneous readings of DO, pH, Specific Conductance, Salinity, and Temperature is a Hach Quanta multi-probe instrument (or equivalent). The Work Plan will be followed for sampling the DO, pH, Specific Conductance, and Temperature, and **AquAeTer** SOP F040 will be used as guidance, which can be found in Appendix D. The Hach instrument manual will be followed for sampling the salinity, which can also be found in Appendix D. A Hach turbidity meter (or equivalent) will be used to collect the turbidity readings. The **AquAeTer** SOP F029 Procedure for Field Turbidity Measurement will be used as guidance (Appendix E).

DO, pH, conductivity, and temperature will also be measured at fixed locations for at least one day at each station. The deployed instruments for the one day readings will be Hach/Hydrolab Mini-Sonde 4a (sonde) multi-probe instruments (or equivalent).

The sondes will be calibrated prior to deployment and after they are retrieved. The Quantas will be calibrated at the beginning and end of each day. The turbidity meter will be calibrated at the beginning and end of each day. Any deviations will be documented in the field notebook.

Chemical Analysis

A sample will be collected for laboratory analysis of the following parameters as specified in the UAA guidance:

- BOD (mg/L);
- Nitrate (mg/L);
- Phosphate (mg/L);
- Total solids (mg/L);
- Hardness (mg/L as $CaCO_3$); and
- Alkalinity (mEq/L).

Samples will be collected, handled and shipped in accordance with the Work Plan. The **AquAeTer** SOP F037 (Appendix F) will be used as guidance for sample collection procedures. The **AquAeTer** SOP F044 (Appendix G) will be used as guidance for sample preparation, handling, storage, and shipping procedures. Any deviations will be documented in the field notebook.

Samples will be analyzed using the following methods or equivalent, which were determined using 40CFR136:

- BOD – Standard Method 5210 B;
- Nitrate – EPA Method 300.0, EPA Method 300.1 or Standard Method 4110 B;
- Phosphate EPA Method 365.3;
- Total solids – ASTM Standard D5907;
- Hardness – EPA Method 130.1 or Standard Method 2430 B or C;
- Alkalinity – EPA Method 310.2 or Standard Method 2320 B; and
- Fecal Coliform.

Fecal coliform or E. Coli will be collected for either laboratory analysis or field analysis. Both fecal coliform and E. Coli have a hold time of 6 hours. Depending on the location of the laboratory, it may not be possible to transmit the sample to the laboratory within the specified hold time. Thus, field analysis methods are being investigated to analyze the sample in the field. If a field method is found, an SOP will be prepared and followed. Any deviations from the method will be documented.

2.2.3 Biological Evaluation

Biological evaluations will determine the diversity of a community and the ability for an ecosystem to recover from pollutional stress.

All biological collection will be conducted in accordance with the Work Plan. Field personnel will use the Arkansas Fish Collection Guidance in Wadeable Streams (Appendix H), Arkansas Game and Fish Commission Fisheries Division Standard Sampling Procedures (Appendix H), the Arkansas Macroinvertebrate Standard Operating Procedures April 2010(Appendix I), the Rapid Bioassessment Protocol (Barbour et al., 1999) (Appendix J), the **AquAeTer** SOP F024 (Appendix K), and the **AquAeTer** SOP F025 (Appendix L) as guidance. Fish and macroinvertebrates collected will be reported to the state, in accordance with requirements in the Arkansas Game and Fish Commission Scientific Collection Permit. If field conditions require any modifications to the work plan, it will be documented in the field notebook.

2.2.3.1 Fish Sampling Stream Collection Procedures

Streams will be sampled using a Smith-Root model 15-B backpack electrofishing device or equivalent. Samples will be collected from all available habitats for two concurrent summers. Field teams will consist of three workers: one to operate probes or carry backpacks, one to net stunned fish, one to carry a bucket for stunned fish and document the fish sampling activities. Reaches of 250 to 500 meters will be sampled from downstream to upstream. In riffles, two workers can position a twenty-foot seine at the toe of the riffle while the other worker will electrofish and disturb the substrate; this will allow stunned fish to drift downstream into the net. A GPS will be used to mark sampling location and a map of widths and lengths of the stream will be drawn. Field data sheets will be completed for each site. These data sheets will include water quality measurements, a habitat assessment, and a description of the fish collected. These sheets are included in Appendix C.

Reaches will be electrofished until the field team leader determines that all meso- (i.e. pool, riffle, run) and microhabitats (i.e. pool tails and margins, glides, etc…) have been sufficiently represented in the sample. Fish less than 20 millimeters will not be included in the reporting and will be released. When possible, individuals will be identified to species in the field and released. Remaining individuals will be preserved in 10% formalin and transported to the biology laboratory for identification. Fish will be identified to the lowest possible taxonomic level. A representative sample of each species will be collected for QA/QC identification in the laboratory.

2.2.3.2 Fish Sampling Lake Collection Procedures

Mossy Lake and Wildcat Lake (or alternate lake) will be sampled for fish using the ADEQ Fisheries Division Standard Sampling Procedures for electrofishing as guidance with the following exceptions: instead of sampling in the spring or fall, sampling will be conducted during the summer, as per the ADEQ fish guidance for sampling streams; and lakes will be sampled using the same sample locations, regardless of size. In addition, the Rapid Bioassessment Protocol will be used as guidance. The habitat assessment field sheets (Appendix C) and fish sampling field sheets (Appendix C) will be attached to any associated field notes.

Electrofishing power should be standardized at each sample site. After measuring water conductivity and temperature, Table 2 within the Arkansas Game and Fish Commission Fisheries Division Standard Sampling Procedures should be used to determine the appropriate power settings, which is included in Appendix H. Electrofishing at these power settings will ensure potential transfer of 3,000 watts from water to fish. Power (watts) is calculated as the volts multiplied by the amps.

The Arkansas Standard Sampling Procedures will be used as guidance during the lake sampling activities. Each lake will be considered one sampling section. Field personnel will attempt to electrofish one complete circuit around the perimeter of the lake. If the field team determines that the perimeter of the lake is not feasible to electrofish, 28 potential sample sites will be located throughout the lake prior to field activities. The field team will then randomly select at least 14 of the 28 potential sample sites to electrofish. Each sample site will be electrofished using 10 minutes of actual pedal-down time. Each lake will be electrofished for a total of no less than 140 minutes. If it is determined in the field that a selected site cannot be sampled, the next site, either to the left or the right, will be determined randomly by the flip of a coin.

A GPS will be used to mark sampling location and a map of widths and lengths of the stream will be drawn. Field data sheets will be completed for each site. These data sheets will include water quality measurements, a habitat assessment, and a description of the fish collected. When possible, large individuals will identified to species in the field and released. Fish less than 20 millimeters will not be included in the reporting and will be released. Remaining individuals will be preserved in 10% formalin and transported to the lab for identification. Fish will be identified to the lowest possible taxonomic level. A representative sample of each species will be collected for QA/QC identification in the laboratory.

2.2.3.3 Fish Sample Storage Procedures

Samples will be placed in five gallon buckets filled with ambient water until fish are identified or preserved for collection. Individuals that will be sent to the laboratory for collection will be preserved in a 10% formalin solution and transported to the laboratory for identification. Samples should loosely fill a jar three fourths (3/4) full or less.

The sample jars will be labeled with tape affixed to the lid of each sample jar. The label will contain the following information:

- Sample site ID
- Location/Stream
- Date and Time
- Collectors' initials
- Sampling Method Used
- Jar ## of ##

Any additional information will be documented in a field notebook with the same information above. The habitat assessment field sheets (Appendix C) and fish sampling field sheets (Appendix C) will be attached to any associated field notes.

2.2.3.4 Macroinvertebrate Stream Collection Procedures

Macroinvertebrate sampling will be completed using ADEQ's Standard Operating Procedure for Macroinvertebrate Sampling Methodology for Wadeable Streams (April 2010) and the Rapid Bioassessment Protocol (Barbour et al., 1999) for guidance.

Sampling will be conducted on a semi-annual (fall and spring) basis. Fall sampling will be conducted from October through early December and spring sampling will be conducted from March through early May. Three sampling methods will be utilized for collecting macroinvertebrates in wadeable streams, contingent upon habitat availability and/or study goals. The five minute traveling kick, systematic transect, and proportional habitat sampling methods are described in this document following general sampling procedures.

Sample reaches will be selected to represent local in stream characteristics. Preferably, reaches should be at least 100 meters upstream of any road or bridge crossing to minimize effects on velocity, depth, and overall habitat quality. There should be no major tributaries, springs, municipal or industrial discharges directly to the stream in the study reach.

Before macroinvertebrate sampling, physical and chemical characteristics of the reach will be measured. Care will be taken to minimize disturbing the sample reach. If the sampler must walk through the stream, he/she should do so just downstream of the area to be sampled for macroinvertebrates. Characteristics to be measured and recorded include, but are not limited to, reach length, substrate type, flow, dissolved oxygen, pH, temperature, bank stability, canopy cover and riparian zone composition. A Habitat Assessment Field sheet will be completed for each reach. A map and GPS coordinates will also be completed.

An individual sampling effort will consist of a "kick" or a "jab." A kick will be performed on substrates such as cobble, pebble, or bedrock within riffle, run, or shallow pool hydraulic units. A jab will be performed in rootwad, detritus, vegetation or deadfall type habitats. A kick is a stationary sampling technique accomplished by positioning the net on the stream bed and disturbing the substrate, 0.5 meters upstream of the net (Barbour et al. 1999). The same amount of effort should be applied to all kicks in order to compare samples on a "catch per unit effort" basis. A jab is a qualitative sampling technique consisting of forcefully jabbing and sweeping a D-frame net into a productive habitat. Each jab should sweep a linear distance of 0.5 meters (Barbour et al. 1999), and the same effort should be applied to each jab. Jabs and kicks should be directed toward the center of the frame so that dislodged organisms are carried into the mouth of the net.

After each kick or jab, the contents of the net will be emptied into a sieve bucket with 500 micron mesh bottom to prevent loss of specimens. This will create a composite sample for the reach. Large debris (rocks, leaves, and sticks) will be brushed and rinsed of any attached organisms and discarded outside of the sample area. Samplers will use caution in order to prevent damaging specimens.

After sampling is complete, the net will be shaken and rinsed with distilled or tap water to dislodge any debris or stray organisms into the sieve bucket. Any remaining visible organisms will be carefully removed from the net with forceps. Remaining debris will be rinsed to remove organisms and discarded.

<u>Five Minute Travelling Kick Method</u>

The five minute traveling kick method will be used when there are ample riffle habitats available for sampling, and research goals do not require that multiple habitats be sampled. This method maximizes the sampler's ability to collect macroinvertebrates from all micro-habitats available within a riffle. Two riffles will be sampled within the selected reach using the kick collection method. Samples will be collected for both riffles for a combined time of five minutes. All kicks will be combined into one composite sample.

A sample will be collected by starting at a downstream corner of a riffle and kicking the substrate along a diagonal path upstream through the riffle. Depending on the size of the riffle, single or multiple paths may need to be kicked.

Although this method is intended to be a qualitative sampling method, timing of the sampling event allows for the approximation of "catch-per-unit-effort."

<u>Systematic Transect Method</u>

The systematic transect method will be used when multiple habitats are to be sampled. A tape measure will be strung along the edge of the selected 50 meter reach while the sampler avoids walking through the sample area. The sampler will begin at the downstream end of the 50 meter reach at a randomly select a starting point: right, middle, or left of the wetted stream bed. The stream can be visually divided into thirds to determine left, center and right. The sampler will then kick or jab, whichever is appropriate, at the first location. Samples will be collected every 5 meters upstream while rotating to the next station to the left.

<u>Proportional Sampling Method</u>

The proportional sampling method will be used when research goals require that all available habitat types be sampled, or when there are no riffle habitats available within a representative reach (such as in the sample ecoregion, the Gulf Coastal ecoregion). A 100 meter reach will be visually examined and relative proportions of available productive macroinvertebrate habitats will be recorded in the field data book. The sampler will then move upstream collecting a total of 20 jabs or kicks over the length of the reach. Each habitat type will be sampled in proportion to its representation within the reach. For example, if snag habitat makes up 50% of the reach, then 50% of the kicks/jabs (10) will be taken in snag habitats.

Habitat Selection

Habitat types are to be selected according to their propensity to provide suitable habitat for macroinvertebrates. Habitat types include, but are not limited to:

Haptobenthos habitats.

Snags—Snags are woody debris, such as downed trees, which have been submerged in the stream for an extended period of time (not recent deadfall). Exact sampling strategy is highly dependent on the structure of the snag. Large diameter snags should be scrubbed by hand to remove macroinvertebrates or avoided altogether for more favorable snag habitat if available. The net should be jabbed into limbs and rootwads and swept back and forth in an effort to dislodge and capture freed macroinvertebrates.

Aquatic Vegetation—Aquatic vegetation should be sampled by jabbing and sweeping the net within the vegetation plot. The net should be swept through standing vegetation in deep water. In shallow water, the net should be jabbed and swept through the vegetation making sure to sample the roots but not dig into the substrate.

Vegetated and Undercut Banks—Undercut banks will be sampled in a similar fashion to the aforementioned methods for snags and vegetation. Rootwads will be sampled in a sweeping motion like submerged limbs.

Herpobenthos Habitats.

Gravel/Cobble—Gravel and cobble will be the dominate substrate in riffle and run habitats for most Arkansas ecoregions. Macroinvertebrates inhabit the surfaces of these substrate particles as well as the interstitial spaces between the particles. These habitats will be sampled using the kick method described above.

Bedrock—Bedrock is often slippery and care should be taken to avoid injury when sampling. The kick method is used to sample bedrock.

Sand and Fine Sediments—Caution should be taken when sampling soft substrates to avoid overloading the sample with debris and sediment. The net should be bumped, not dragged, along the bottom to dislodge macroinvertebrates into the water column. The net should be swept back and forth to capture macroinvertebrates dislodged and floating within the water column.

2.2.3.5 Macroinvertebrate Lake Collection Procedures

Mossy Lake and reference lake will be sampled for macro invertebrates using the ADEQ Fisheries Division Standard Sampling Procedures, Recommended Protocols for Sampling and Analyzing Subtidal Benthic Macroinvertebrate Assemblages in Puget Sound (EPA 1987) and the Rapid Bioassessment Protocol as guidance. The habitat assessment field sheets (Appendix C) and macro invertebrate sampling field sheets (Appendix C) will be attached to any associated field notes.

Each lake will be have 28 potential sample sites located throughout the lake prior to field activities. The field team will then randomly select at least 14 of the 28 potential sample sites to sample. Each location will use a ponar grab to collect the sample. If no sediment was collected at a station in the first ponar grab, multiple grabs will be taken. If it is determined in the field that a selected site cannot be sampled, the next site, either to the left or the right, will be determined by the flip of a coin.

A GPS will be used to mark sampling location and a map of widths and lengths of the stream will be drawn. Field data sheets will be completed for each site. These data sheets will include water quality measurements, a sediment description, and a description of the macroinvertebrates collected. The ponar grabs will be field screened for live organisms and live organisms are to be collected and placed into sample jars, described below.

2.2.3.6 Macroinvertebrate Sample Storage Procedures

Macro invertebrate samples will be placed in labeled ½ gallon, plastic wide-mouth jars, filled with 70% denatured ethanol. Samples should loosely fill a jar three fourths (3/4) full or less. There should always be enough room in the jar to have at least 5 cm (2 inches) of free ethanol above the sample. Samples will be stored in a laboratory for subsampling and identification.

The jar will be labeled with tape affixed to the lid of each sample jar. The label will contain the following information:

- Sample site ID
- Location/Stream
- Date and Time
- Collectors' initials
- Sampling Method Used
- Jar ## of ##

Any additional information will be documented in a field notebook with the same information above. The habitat assessment field sheets (Appendix C) and macroinvertebrate sampling field sheets (Appendix C) will be attached to any associated field notes.

If a sample contains a large amount of algae or other material that will decay rapidly, it may be necessary to occasionally drain the liquid from the sample and add fresh ethanol. This will help preserve the morphological integrity of the invertebrates and aid in taxonomic identification.

2.2.3.7 Macroinvertebrate Laboratory Analysis

The ADEQ Standard Operating Procedures for Sampling Macroinvertebrates in Wadeable Streams will be used as guidance for the subsampling procedure used in Laboratory Analysis. The composite sample will be placed in a 500 micron sieve. The sieve will be marked where each grid square will measure 5.08 cm x 5.08 cm. Silt, clay, and fine sand will be gently rinsed from the sample and large debris will be rinsed, inspected for macroinvertebrates, and discarded. Once the composite sample is free of large debris and fine sediment, it will be evenly distributed on the grid, using a low velocity spray nozzle and/or the sampler's hand. Squares will be selected one at a time using a random numbers table or dice. The entire contents of the square will be placed into a sorting pan. The square will be visibly inspected to ensure all organisms are removed. Any organism that spans multiple squares will be considered as in the square that contains its head. If an organism without an easily distinguishable head (such as an Oligochaet) spans multiple squares, it will be considered as in the square that contains the majority of the body.

A dissecting microscope will be used to count the randomly chosen squares until a subsample of 300 organisms (+/- 10%) is obtained. All of the individuals in a square will be counted regardless if the 300 organisms are reached. Organisms must contain a head and enough features to identify it to a reasonable taxonomic level to be counted. Also, organisms cannot be counted if they only contain an empty shell or just skin. Oligochaets can be counted without a head if one terminal end is present

Subsamples will be placed in a 4 oz. jar with 70% ethanol. Each subsample jar will be labeled with a piece of tape on the outside of the top of the lid and a piece of paper inside the jar. Labels will be clearly written, in pencil, with the site number, sample collection date, number of individuals contained within the subsample, initials of the person who collected the sample, subsample date, and subsampler initials. All applicable field forms will be kept on file with corresponding lid identification number.

Macroinvertebrates will be identified to the lowest taxonomic level feasibly possible as presented in the table below.

Table 6. Taxonomic Level of Identification

TAXONOMIC LEVEL	GROUPS
Genus	Plecoptera, Ephemeroptera, Odonata, Trichoptera, Megaloptera, Neuroptera, Lepidoptera, Coleoptera, Hemiptera, Diptera (in part),
Tribe	Chironominae
Family	Diptera (in part), Crustacea, Mollusca
Order	Other non-insect groups

Distinct taxa groups for each sample will be placed into one or two dram glass vial filled with 70% ethanol, to 90% capacity, and stored in a partitioned box. Vials will be logged onto the macroinvertebrate identification form that is presented in Appendix C. The vials in the partitioned box will correspond with the order they are labeled on the identification form. The Quality Control procedures will be followed that are outlined in the **AquAeTer** QAPP.

2.2.4 Process to Prevent Cross Contamination

To prevent cross-contamination of water samples, each discrete sample will be collected directly from the stream into the composite sample container. Only new sample containers will be utilized.

2.2.5 Documentation of Field Sampling Activities

AquAeTer personnel will use the **AquAeTer** SOP F050 Field Book Procedure as guidance (Appendix A). Sampling activities will be documented in a field logbook or on field log sheets for pertinent tasks. At each sample site the following information will be recorded: location, sampling time, date, water depth and appearance, standard water quality parameters (DO, pH, conductivity, turbidity, and temperature), ambient weather conditions, any observations or anomalies such as unusual odors, and the names of the field crew. In addition, physical descriptions of each sampling location will be documented, along with GPS latitude and longitude coordinates. Any deviations will be documented in the field notebook.

2.2.6 Recording Data

For the purposes of this section and subsequent sections, all field and laboratory personnel follow the basic rules for recording information as documented below:

1. Legible writing; and

2. Correction of errors with a single line followed by an initial and date.

2.2.7 Failures in Sampling Methods Requirements and/or Deviations from Sample Design and Corrective Action

Any deviations from the Work Plan and the QAPP will be documented in the field notebook. Deviations from the Work Plan and QAPP will be decided by the Technical Director. The field team leader or project manager will attempt to contact the Technical Director when a deviation is required; however, due to the remote location of the area, the Technical Director may be inaccessible. If the Technical Director cannot be reached, the field team leader or project manager will document any deviation that occurs. The Technical Director will determine if the deviation from the Work Plan and QAPP compromises the validity of the resulting data. The Technical Director will decide to accept or reject data associated with the sampling event, based on best professional judgment.

2.3 SAMPLE HANDLING AND CUSTODY PROCEDURES

2.3.1 Field Measurements

Field measurements for water quality will be collected according to the Work Plan and using the **AquAeTer** SOP F040 Field Measurements as guidance (Appendix D). Any deviations will be documented in the field notebook.

2.3.2 Field Sampling

Field water quality samples will be collected according to the Work Plan and using the **AquAeTer** SOP F037 Surface-Water Sampling Procedure as guidance (Appendix F). Any deviations will be documented in the field notebook.

2.3.3 Chain-of -Custody

All samples will be handled under Chain of Custody protocols, using the **AquAeTer** SOP F045 Custody Procedures as guidance (Appendix M). The laboratory will follow their laboratory chain of custody procedures. Any deviations will be documented in the field notebook.

2.3.4 Sample Labeling

Samples will be labeled following the Work Plan procedures and using the **AquAeTer** SOP F044 Sample Preparation, Handling, Storage, and Shipping Procedure as guidance (Appendix G). Any deviations will be documented in the field notebook.

2.3.5 Failures in Chain-of-Custody and Corrective Action

Any failures associated with chain-of-custody procedures will be immediately reported to the Project Manager, Technical Director, and the laboratory. The Technical Director will determine if the procedural violation may have compromised the validity of the resulting data. The Project Manager will document the violation in the field notebook if the Project Manager is in the field or in the project files if the Project Manager is in the office.

2.4 ANALYTICAL METHODS REQUIREMENTS

2.4.1 Standards Traceability

The ADEQ-approved Laboratory will follow its Quality Assurance Plan in ensuring that all standards used in the laboratory are traceable to certified reference materials and that standard preparation is fully documented and maintained in a standards log book. Each documentation includes information concerning the standard identification, starting materials, including concentration, amount used and lot number; date prepared, expiration date and preparer's initials/signature. The reagent bottle is labeled in a way that will trace the reagent back to preparation.

2.4.2 Failures or Deviations in Analytical Method Requirements and Corrective Actions

Any failures or deviations in the analytical methods and any corrective actions will be noted in the Case Narrative in the final laboratory report.

2.5 QUALITY CONTROL REQUIREMENTS

2.5.1 Sampling Quality Control Requirements and Acceptability Criteria

The method for rejection of samples will be based on statistically derived QA limits or the data quality objectives, as defined previously. Required QC checks for field samples will include the following elements. Sample handling QC check will be performed by the analysis of one field blank per sampling trip. The field blank will be created by adding standard de-ionized water to an empty bottle at the time of sample collection. This blank will be logged into the laboratory and analyzed for all project parameters. The results will be compared to analytical instrument blanks to determine any possible contamination from sample handling. Any deviation of fifteen percent over the detection limit or greater will be reported in the final QA report. Sampling precision will be checked by taking one field duplicate grab sample per sampling deployment. Standard deviations will be calculated from these duplicates and reported in the QA report.

2.5.2 Laboratory Measurement Quality Control Requirements and Acceptability Criteria

Detailed laboratory QC requirements are contained within the individual Laboratory Quality Manuals. The minimum requirements that all participants abide by are stated below. Lab QC sample results will be reported with the analytical results on the laboratory report form (see Section C2).

Laboratory duplicate - Laboratory duplicates are used to assess precision. A laboratory duplicate is prepared by splitting aliquots of a single sample (or a matrix spike or a laboratory control standard) in the laboratory. Both samples are carried through the entire preparation and analytical process. Laboratory duplicates and matrix spikes are performed for each sampling event.

Precision is calculated by the relative percent difference (RPD) of duplicate results as defined by 100 times (the difference (range) of each duplicate set, divided by the average value (mean) of the set). For duplicate results, X_1 and X_2, the RPD is calculated from the following equation: *Note: If other formulas apply, adjust appropriately*.

$$RPD = ((X_1 - X_2)/\{(X_1+X_2)/2\}) * 100$$

Laboratory Control Standard (LCS) - A laboratory control sample is analyte-free water spiked with the analyte of interest prepared from standardized reference material. The laboratory control standard is generally spiked into laboratory pure water at a level less than or equal to the mid-point of the calibration curve for each analyte. The LCS is carried through the complete preparation and analytical process. The LCS is used to document the accuracy of the method due to the analytical process. LCSs are generally run at a rate of one per batch. Acceptability criteria are laboratory specific and usually based on results of past laboratory data. LCSs are routinely incorporated into the analysis program. The analysis of LCSs is a measure of accuracy and is calculated by percent recovery (%R). Percent recovery is defined as 100 times the observed concentration, divided by the true concentration of the spike.

The formula used to calculate percent recovery, where %R is percent recovery; SR is the sample result; SA is the spike added:

$$\%R = (SR/SA) * 100$$

Matrix spikes (MS) - A matrix spike is an aliquot of sample spiked with a known concentration of the analyte of interest. Matrix spikes are performed for each sampling event. Percent recovery of the known concentration of added analyte is used to assess accuracy of the analytical process. The spiking occurs prior to sample preparation and analysis. Spiked samples are routinely prepared and analyzed at a rate of 10% of samples processed for each sampling event. The MS is spiked at a level less than or equal to the midpoint of the calibration or analysis range for each analyte. The MS is used to document the accuracy of a method due to sample matrix and not to control the analytical process. Acceptability criteria are calculated by Percent Recovery. Percent Recovery (%R) is defined as 100 times (the observed concentration, minus the sample concentration, divided by the true concentration of the spike).

The formula used to calculate percent recovery, where %R is percent recovery; SSR is the observed spiked sample concentration; SR is the sample concentration; and, SA is the spike added; is:

$$\%R = ((SSR - SR)/SA) * 100$$

Method Blank- A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as used in the sample processing and analyzed with each batch. The method blank is carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination from the analytical process. The analysis of method blanks should yield values less than the Minimum Analytical Level. For very high level analyses, blank value should be less than 5% of the lowest value of the batch.

Additional method specific QC requirements - Additional QC samples are run (e.g., surrogates, internal standards, continuing calibration samples, interference check samples) as specified in the methods. These include instrument calibrations for spectrophotometers, zero-saturation standards for DO, etc. The requirements for these samples, their acceptance criteria, and corrective action are method-specific.

2.5.3 Failures in Field and Laboratory Quality Control and Corrective Action

Sampling quality control deviations will be documented in the field notebook and reported to the Project Manager. Professional judgment will be relied upon in evaluating results which may not subscribe directly to quality control requirements. Documentation of such determinations will be made in the final report.

Laboratory measurement quality control failures are evaluated by the laboratory staff. The failure in Laboratory quality control and any corrective actions will be noted in the case narrative in the final laboratory report.

2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Field equipment testing, inspection, calibration, and maintenance are detailed in section 2.2 of this document. Autonomous water quality datasondes will be calibrated according to manufacturing specifications. Specifically, each sensor (conductivity, DO, pH) will be calibrated using standards (100% saturation for DO) in the laboratory prior to field deployment. After retrieval, post-calibration will be checked and documented.

All laboratory tools, gauges, instrument, and equipment testing and maintenance requirements are contained within the laboratory quality assurance manual (QAM). Testing and maintenance records are maintained and are available for inspection. Instruments requiring daily or in-use testing include, but are not limited to, water baths, ovens, autoclaves, incubators, refrigerators, and laboratory pure water. Critical spare parts for essential equipment are maintained to prevent downtime. Maintenance records are available for inspection.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

2.7.1 Field Equipment

Field Equipment will be calibrated according to the manufacturer's instructions at the beginning and end of each field day, unless equipment is deployed for multiple days; then the equipment will be calibrated before and after deployment. Possible post calibration error limits and the disposition resulting from any errors will be documented in the report.

2.7.2 Laboratory Equipment

Detailed Laboratory calibrations are contained within the QAM. The laboratory QAM identifies all tools, gauges, instruments, and other sampling, measuring, and test equipment used for data collection activities affecting quality that must be controlled and, at specified periods, calibrated to maintain bias within specified limits. Equipment requiring periodic calibrations includes, but is not limited to, thermometers, pH meters, balances, incubators, turbidity meters, and analytical instruments.

2.8 INSPECTION/ACCEPTANCE REQUIREMENT FOR SUPPLIES AND CONSUMABLES

No special requirements for acceptance are specified for field sampling supplies and consumables. Laboratory acceptance requirements in order to satisfy the technical and quality objectives of this project are documented in the laboratory's QAM.

2.9 DATA AQUISTION REQUIREMENTS

AquAeTer personnel, in accordance with the requirements of the Work Plan and this QAPP, will generate primary data used for this assessment. Any additional existing data used to support this project will be reviewed by **AquAeTer** to determine its relevancy and appropriateness for inclusion in this analysis. Additional data may include reports and research conducted by local, state, and federal agencies; previous published reports; and data collected by Georgia-Pacific. The review process will include a clear documentation of the quality control methods used in the collection, analysis, and reporting phases of each added body of information. USEPA and ADEQ-approved QAPPs for other data will be appended to the additional data or clearly referenced.

2.10 DATA MANAGEMENT

Data collected in the field will be entered in the field logbook or field log sheets. At the end of each day, the field team will attempt to copy the field notes daily and store them separately during field work. This data will be input into computer spreadsheet format for electronic use and presentation. All data entry will be reviewed according to **AquAeTer**'s QA/QC requirements.

Data from the laboratory will be transferred in hardcopy or electronically in spreadsheet or database format. In the event the data is in hardcopy format, the data will be input into computer spreadsheet format for electronic use and presentation. All data entry will be reviewed according to **AquAeTer**'s QA/QC requirements.

SECTION 3

ASSESSMENT AND OVERSIGHT

3.1 ASSESSMENTS AND RESPONSE ACTIONS

3.1.1 Information Expected

This sampling project will yield physical, chemical, and biological descriptions of eight sites in southern Arkansas. These data will be analyzed to determine if aquatic life uses are appropriately supported in Coffee Creek and Mossy Lake.

3.1.2 Success Criteria

The criteria for success for this sampling project will be completion of each task within the designated quality control criteria.

AquAeTer will perform the following types of assessments and response action for data collection activities on an as needed basis:

- Status Monitoring and Oversight,
- Monitoring Systems Audit,
- Monitoring Systems Audit/Lab Inspection, and
- Performance Evaluation Samples.

3.1.3 Corrective Action

The Project Manager will be responsible for implementing and tracking corrective action procedures as a result of audit findings. All audit findings and corrective actions will be documented.

3.2 REPORTS TO MANAGEMENT

3.2.1 Reports to Project Management

Laboratory data reports contain QC information and will be reviewed by the **AquAeTer** Project Manager. Copies of field data sheets will also be given to the Project Manager.

3.2.2 Reports to ADEQ Project Management

A Final Report will be provided to ADEQ and Georgia-Pacific at the end of the study. The report will provide background for the study, describe the methodology used and any delays, problems, and collective actions, report the findings and interpret the data to assess aquatic life use potential and water quality standards attainment.

SECTION 4

DATA VERIFICATION AND USABILITY

4.1 DATA REVIEW, VERIFICATION, AND VALIDATION

All data obtained from field and laboratory measurements will be reviewed and verified for integrity and continuity, reasonableness, and conformance to project requirements. Only those data that are supported by appropriate quality control data and meet the data quality objectives defined for this project will be considered acceptable.

The procedures for verification of data are described below in Section 4.2. The Project Manager is responsible for ensuring that field data and laboratory data are properly reviewed, verified, and submitted in the required format. For this project, data validation will not occur since the laboratory selected will be approved by ADEQ and will ensure that methods are followed appropriately.

4.2 VERIFICATION METHODS

All data will be verified to ensure they are representative of the samples analyzed and locations where measurements were made, and that the data and associated quality control data conform to project specifications. Verification refers to the process of confirming that a process or procedure was followed. The staff and management of the respective field and laboratory tasks are responsible for verifying the data each task generates or handles. The field and laboratory tasks ensure the verification of raw data, electronically generated data, and data on chain-of-custody forms and hard copy output from instruments.

Verification of data will be performed using self-assessments and peer review, as appropriate to the project task, followed by technical review by the manager of the task. The data to be verified are evaluated against project specifications and are checked for errors, especially errors in transcription, calculations, and data input. Potential outliers are identified by examination for unreasonable data, or identified using computer-based statistical software. If a question arises or an error or potential outlier is identified, the manager of the task responsible for generating the data is contacted to resolve the issue. Issues that can be corrected will be corrected and documented electronically or by initialing and dating the associated paperwork. If an issue cannot be corrected, the task manager consults with higher-level project management to establish the appropriate course of action, or the data associated with the issue are rejected.

4.3 RECONCILIATION WITH DATA QUALITY OBJECTIVES

The Project Manager will evaluate the data to ensure that they meet the data quality objectives. If the data do not meet the goals, they will be documented. Reporting of the data in the final report will be at the Project Manager's judgment.

Results obtained from this sampling project will be analyzed for anomalies based on the criteria described in Sections 1, 2, and 3. The data will meet these criteria, or will documented. Any modifications of procedures or assumptions will be documented

4.3.1 Additional Data To Be Considered

AquAeTer may incorporate existing data from Georgia-Pacific, the Parsons Report, and from state and federal agencies. Data from sources outside of this QAPP are not to be construed as conforming to this QAPP; sources of additional data will be clearly cited.

TABLE 1. UAA OVERVIEW
Georgia-Pacific Crossett
Crossett, Arkansas

STATION NO.	NAME	WATER QUALITY PARAMETERS	STUDY			
			HABITAT ASSESSMENT	MACRO BENTHOS	FISH	ANALYTICAL
1	Background Coffee Creek	S, S1, S2, F	S, S1, S2, F	S, F	S1, S2	S, S1, S2, F
2	Coffee Creek at GP Property	S, S1, S2, F	S, S1, S2, F	S, F	S1, S2	S, S1, S2, F
3	EPA Reference Site	S, S1, S2, F	S, S1, S2, F	S, F	S1, S2	S, S1, S2, F
4	Indian Creek	S, S1, S2, F	S, S1, S2, F	S, F	S1, S2	S, S1, S2, F
5	Mossy Lake	S, S1, S2, F	S, S1, S2, F	S, F	S1, S2	S, S1, S2, F
6	Old Channel of Coffee Creek	S, S1, S2, F	S, S1, S2, F	S, F	S1, S2	S, S1, S2, F
7	Reference Coffee Creek in FWR	S, S1, S2, F	S, S1, S2, F	S, F	S1, S2	S, S1, S2, F
8	Reference Mossy lake at Wildcat Slough in FWR	S, S1, S2, F	S, S1, S2, F	S, F	S1, S2	S, S1, S2, F

TABLE 2. UAA OUTLINE - SUMMER 1
Georgia-Pacific Crossett
Crossett, Arkansas

STATION NO.	NAME	WATER QUALITY PARAMETERS	STUDY			
			HABITAT ASSESSMENT	MACRO BENTHOS	FISH	ANALYTICAL
1	Background Coffee Creek	X	X		X	X
2	Coffee Creek at GP Property	X	X		X	X
3	EPA Reference Site	X	X		X	X
4	Indian Creek	X	X		X	X
5	Mossy Lake	X	X		X	X
6	Old Channel of Coffee Creek	X	X		X	X
7	Reference Coffee Creek in FWR	X	X		X	X
8	Reference Mossy lake at Wildcat Slough in FWR	X	X		X	X

TABLE 3. UAA OUTLINE - FALL
Georgia-Pacific Crossett
Crossett, Arkansas

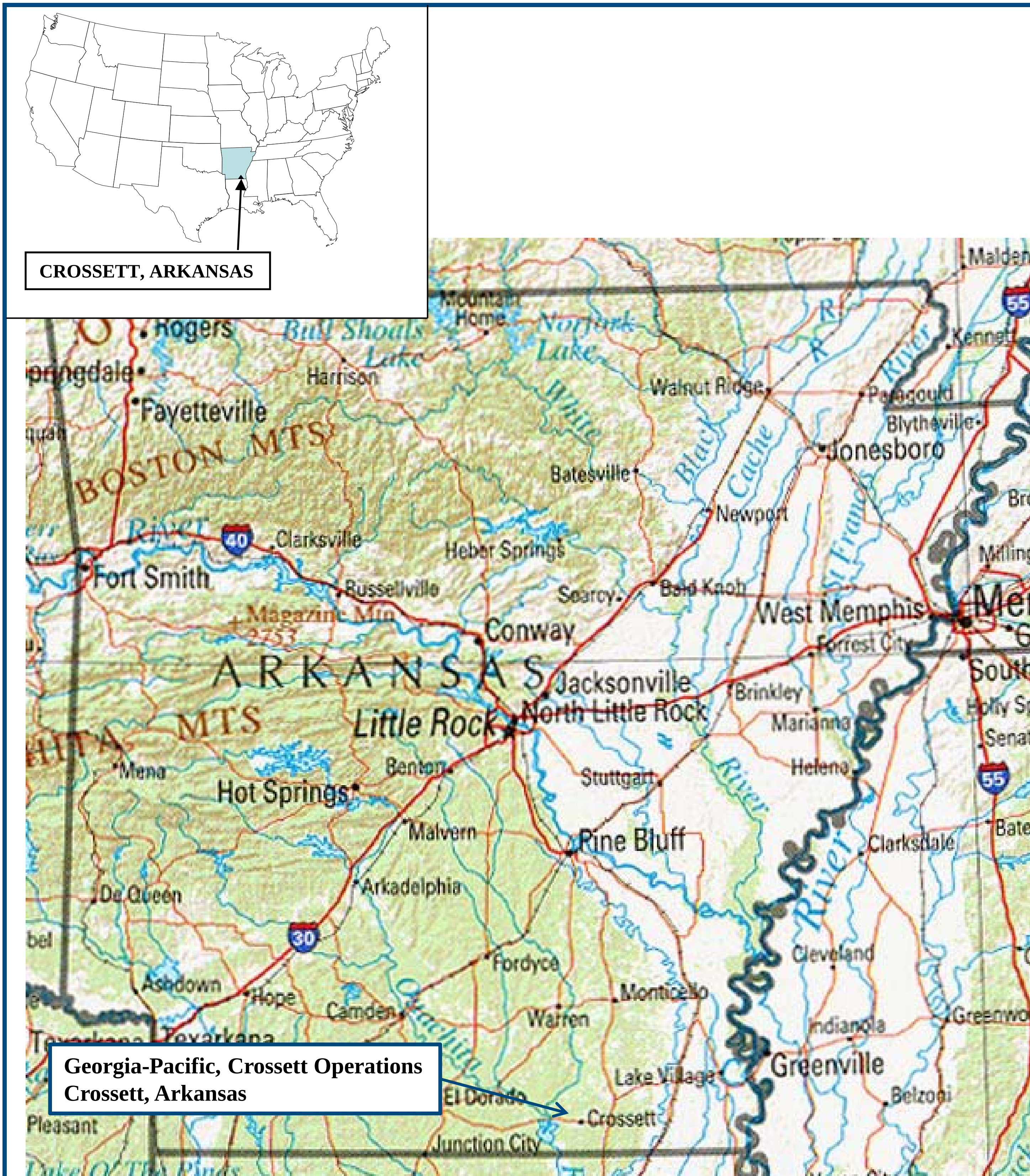
STATION NO.	NAME	WATER QUALITY PARAMETERS	STUDY			
			HABITAT ASSESSMENT	MACRO BENTHOS	FISH	ANALYTICAL
1	Background Coffee Creek	X	X	X		X
2	Coffee Creek at GP Property	X	X	X		X
3	EPA Reference Site	X	X	X		X
4	Indian Creek	X	X	X		X
5	Mossy Lake	X	X	X		X
6	Old Channel of Coffee Creek	X	X	X		X
7	Reference Coffee Creek in FWR	X	X	X		X
8	Reference Mossy lake at Wildcat Slough in FWR	X	X	X		X

TABLE 4. UAA OUTLINE - SPRING
Georgia-Pacific Crossett
Crossett, Arkansas

STATION NO.	NAME	WATER QUALITY PARAMETERS	STUDY			
			HABITAT ASSESSMENT	MACRO BENTHOS	FISH	ANALYTICAL
1	Background Coffee Creek	X	X	X		X
2	Coffee Creek at GP Property	X	X	X		X
3	EPA Reference Site	X	X	X		X
4	Indian Creek	X	X	X		X
5	Mossy Lake	X	X	X		X
6	Old Channel of Coffee Creek	X	X	X		X
7	Reference Coffee Creek in FWR	X	X	X		X
8	Reference Mossy lake at Wildcat Slough in FWR	X	X	X		X

TABLE 5. UAA OUTLINE - SUMMER 2
Georgia-Pacific Crossett
Crossett, Arkansas

STATION NO.	NAME	WATER QUALITY PARAMETERS	STUDY			
			HABITAT ASSESSMENT	MACRO BENTHOS	FISH	ANALYTICAL
1	Background Coffee Creek	X	X		X	X
2	Coffee Creek at GP Property	X	X		X	X
3	EPA Reference Site	X	X		X	X
4	Indian Creek	X	X		X	X
5	Mossy Lake	X	X		X	X
6	Old Channel of Coffee Creek	X	X		X	X
7	Reference Coffee Creek in FWR	X	X		X	X
8	Reference Mossy lake at Wildcat Slough in FWR	X	X		X	X



CLIENT: Georgia-Pacific Crossett	**FIGURE 1**
LOCATION: Crossett, Arkansas	**LOCATION MAP**
PROJECT/FILE: 112054	

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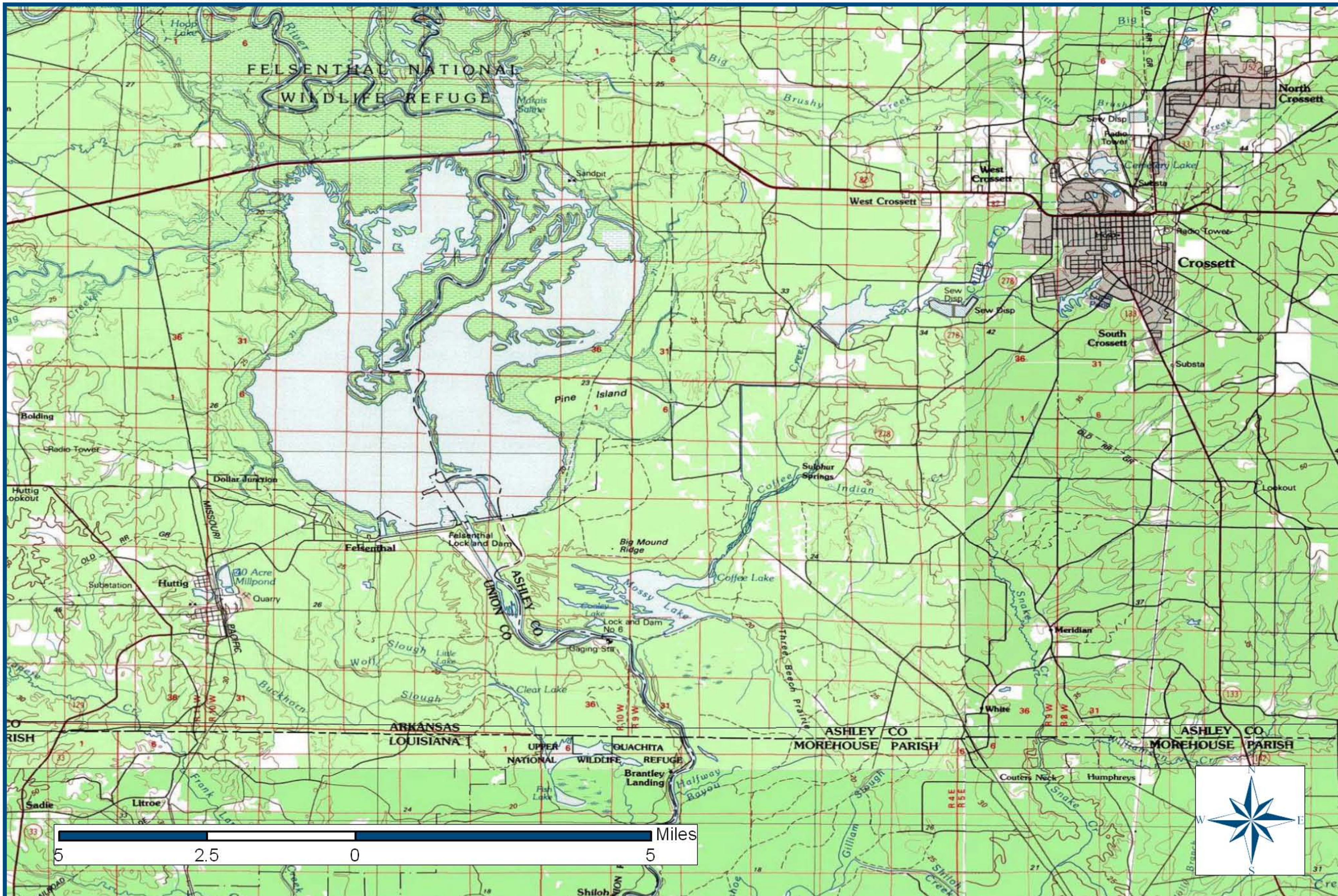

CLIENT: Georgia-Pacific Crossett

LOCATION: Crossett, Arkansas

PROJECT/FILE: 112054

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FIGURE 2

AREA MAP

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CLIENT: Georgia-Pacific Crossett
LOCATION: Crossett, Arkansas
PROJECT/FILE: 112054

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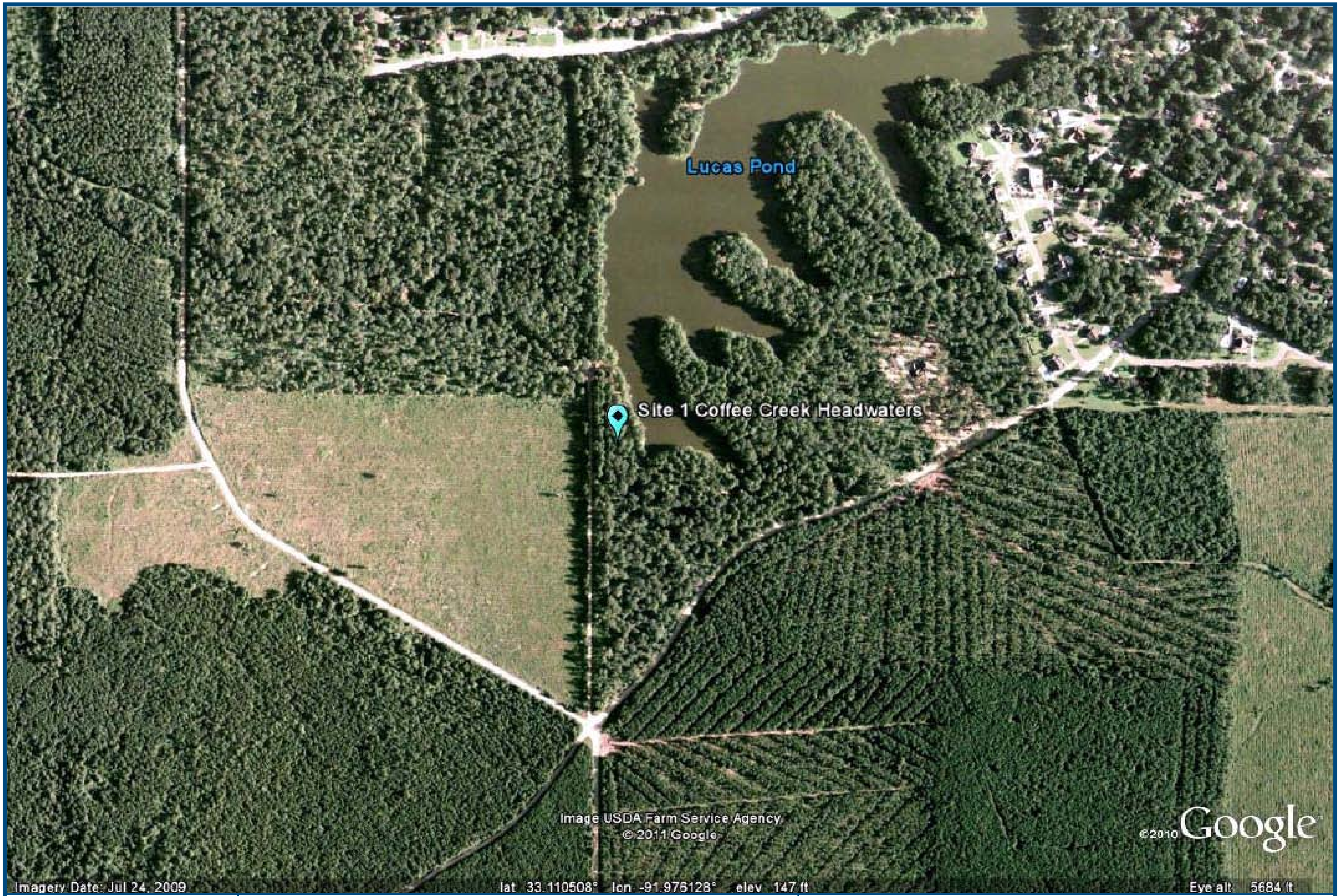
FIGURE 3
APPROXIMATE SAMPLING LOCATION STATIONS



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CLIENT: Georgia-Pacific Crossett
LOCATION: Crossett, Arkansas
PROJECT/FILE: 112054

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FIGURE 4
APPROXIMATE SAMPLING LOCATION
SITE 1

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CLIENT: Georgia-Pacific Crossett
LOCATION: Crossett, Arkansas
PROJECT/FILE: 112054

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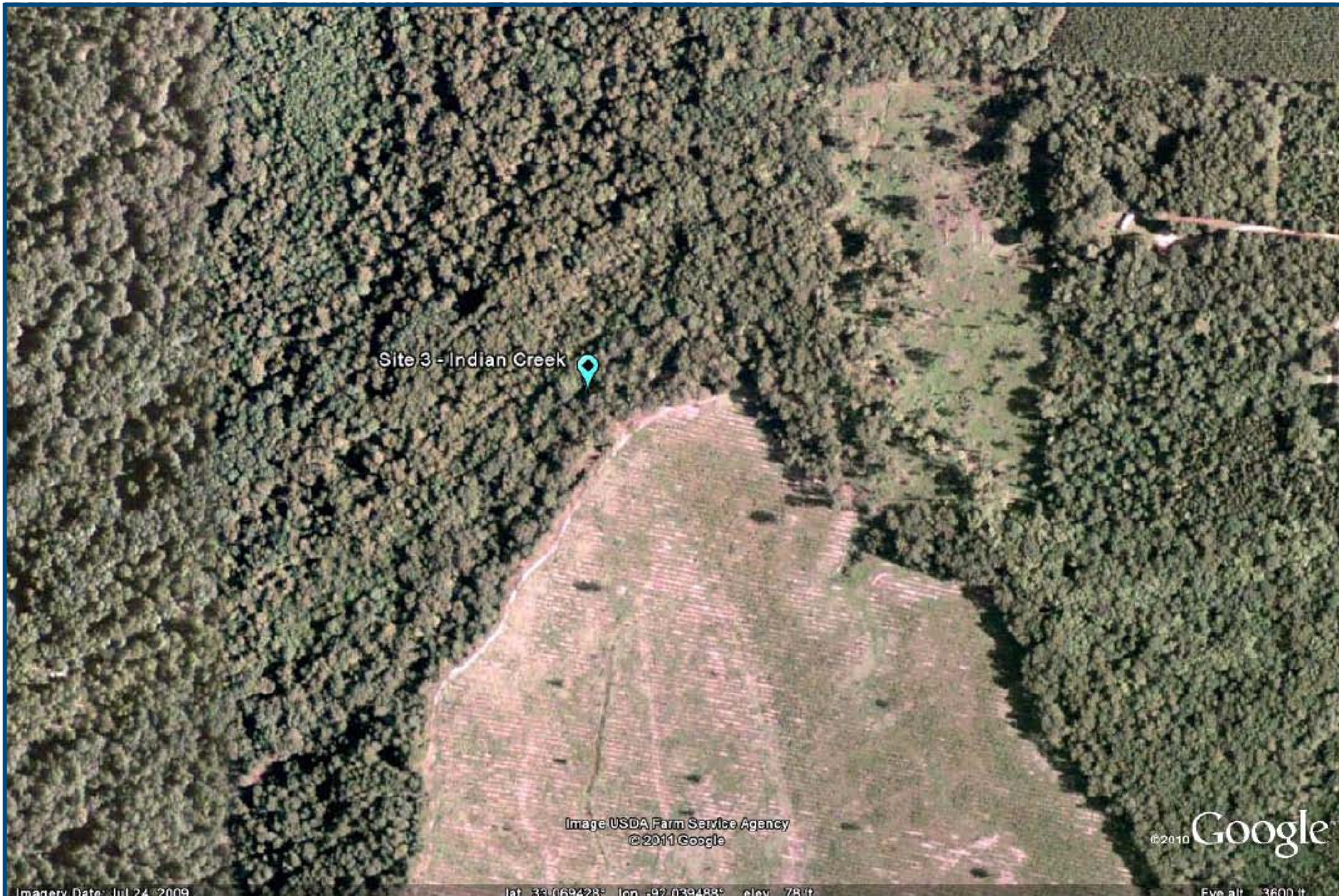
FIGURE 5
APPROXIMATE SAMPLING LOCATION
SITE 2



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CLIENT: Georgia-Pacific Crossett	
LOCATION: Crossett, Arkansas	
PROJECT/FILE: 112054	

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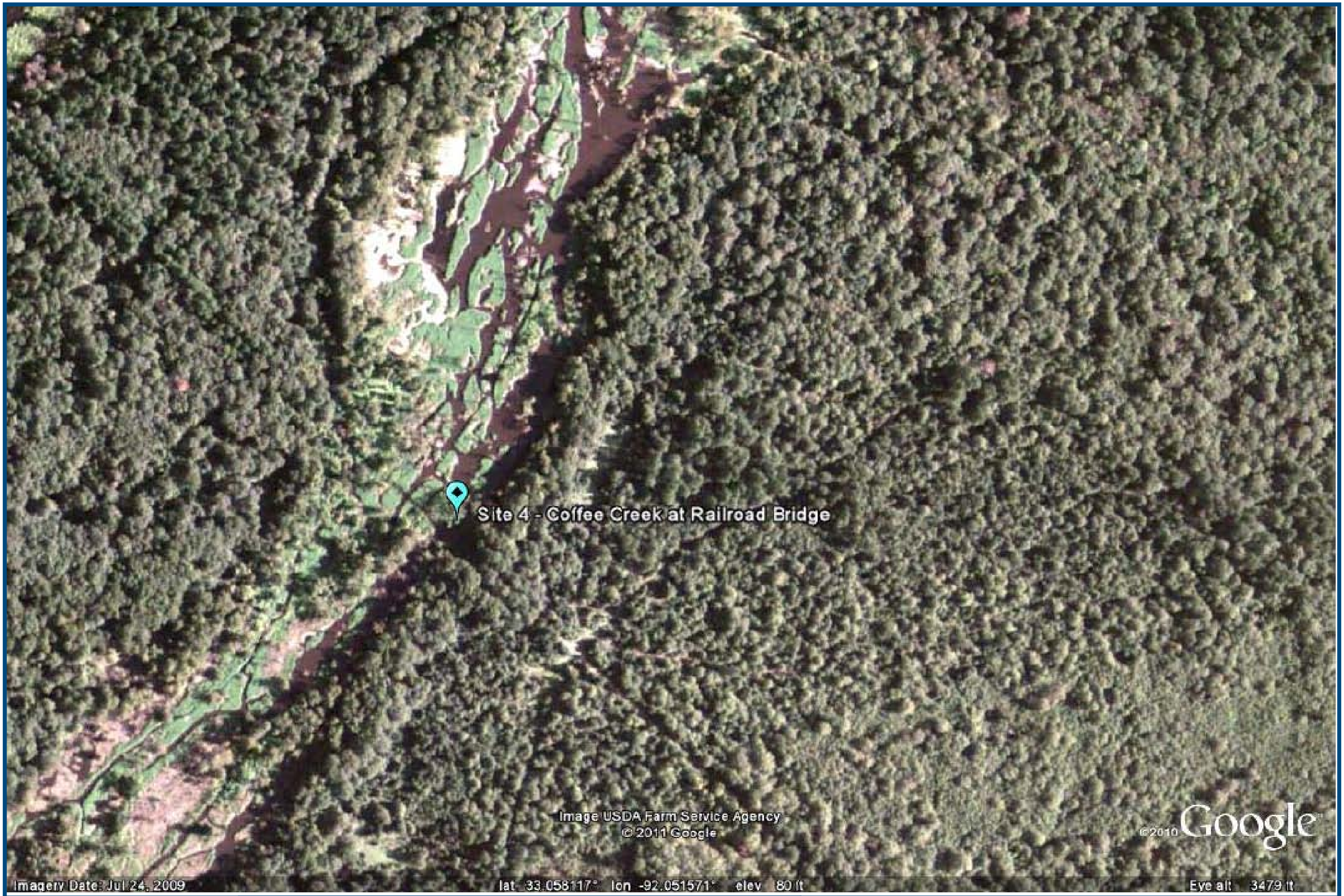
FIGURE 6
APPROXIMATE SAMPLING LOCATION
SITE 3



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CLIENT: Georgia-Pacific Crossett
LOCATION: Crossett, Arkansas
PROJECT/FILE: 112054

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FIGURE 7
APPROXIMATE SAMPLING LOCATION
SITE 4

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CLIENT: Georgia-Pacific Crossett	
LOCATION: Crossett, Arkansas	
PROJECT/FILE: 112054	

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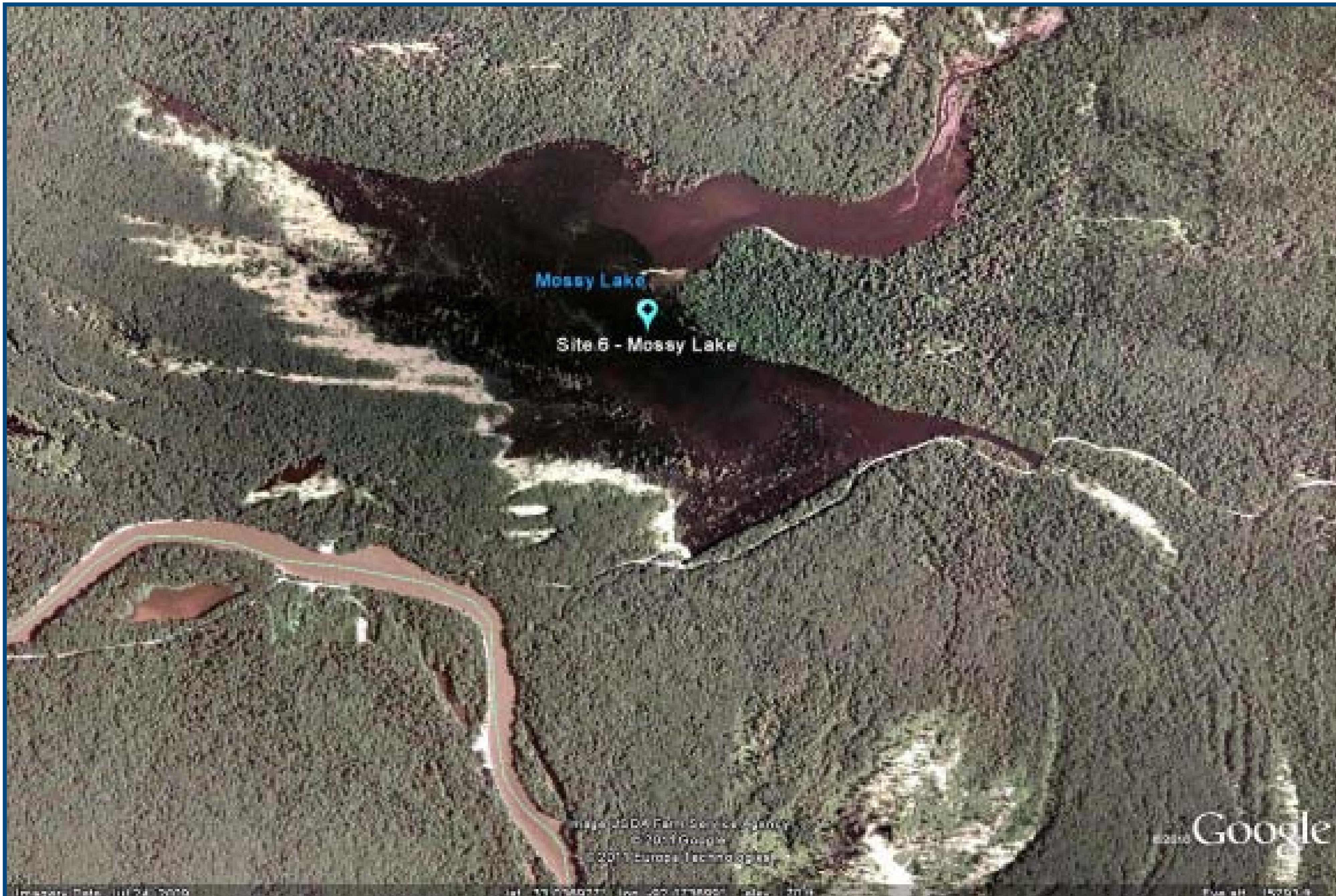
FIGURE 8
APPROXIMATE SAMPLING LOCATION
SITE 5



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CLIENT: Georgia-Pacific Crossett
LOCATION: Crossett, Arkansas
PROJECT/FILE: 112054

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FIGURE 9
APPROXIMATE SAMPLING LOCATION
SITE 6

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CLIENT: Georgia-Pacific Crossett
LOCATION: Crossett, Arkansas
PROJECT/FILE: 112054

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FIGURE 10
APPROXIMATE SAMPLING LOCATION
SITE 7

CLIENT: Georgia-Pacific Crossett
LOCATION: Crossett, Arkansas
PROJECT/FILE: 112054

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FIGURE 11
APPROXIMATE SAMPLING LOCATION WITH ALTERNATE LOCATIONS - SITE 8